UNIVERSITI
TEKNOLOGI
PETRONAS

FINAL EXAMINATION
SEPTEMBER 2016 SEMESTER

COURSE	:	**QAB4063 – PETROLEUM GEOCHEMISTRY & BASIN MODELLING (ME)**
DATE	:	**21st DECEMBER 2016 (WEDNESDAY)**
TIME	:	**9.00 AM – 12.00 NOON (3 hours)**

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. Do not open this Question Booklet until instructed.

Note : There are **SIX (6)** pages in this Question Booklet including the cover page.

1. a. Discuss why alkanes do not conduct electricity.

[5 marks]

b. List the main differences between alkanes and alkenes.

[5 marks]

c. Analyze the differences between diagenesis and catagenesis.

[10 marks]

2. a. Analyze the main features of kerogen.

[5 marks]

b. Evaluate the major characteristics of shallow diagenesis of organic matter.

[10 marks]

c. Assess the **THREE (3)** factors that affect preservation (or destruction) of organic matter.

[10 marks]

d. Evaluate the differences in H/C and O/C ratios between Type I and Type II kerogen.

[5 marks]

3. a. Construct a burial history curve assuming no change in thickness due to burial and compaction over geologic time using the following geological data for the Malay Basin.

[10 marks]

Stratigraphic Section.

Groups A, B : 1000 feet thick

Pliocene age (duration 10 MY). Marine sediments

Groups D, E, F, H and I : 5000 feet thick

Miocene age (duration 8 MY). Parallic sediments

Group J : 500 feet thick

Lower Miocene age (duration 2 MY). Deltaic sediments

Group K shale : 1000 feet thick

Oligocene age (duration 2 MY). Lacustrine

Group K sandstone : 500 feet thick

Oligocene (duration 1 MY). Braided stream sediments

Group L sandstone : 600 feet thick

Oligocene (duration 2 MY). Braided stream sediments

Basement granite (90 MY).

b. Reconstruct the heat flow history for the Malay Basin using the data given below.

Total thickness of sedimentary section = 8600 feet.

Total age duration = 10MY + 8MY + 2MY + 2MY + 1MY + 2MY = 25MY.

Assume : Global average 1.5 HFU

Malay Basin average 2.6 HFU

Maximum heat flow 4 HFU during crustal stretching (10 MY period)

Uplift and erosion of granite (10 MY period)

[10 marks]

4. a. Assess the geological conditions that are conducive for the formation of gas hydrates.

[5 marks]

b. Assess why gas hydrates has not yet been developed.

[5 marks]

c. Coal seam methane is a valuable source of energy. Wells drilled into coal seams often produce lots of water initially before methane gas is produced. Analyze the geological reasons responsible for this production phenomenon.

[5 marks]

d. Some coal seams have more methane gas than others. Propose the geological conditions that favor high methane coal seams.

[5 marks]

5. a. The reservoir pressure decline curve is an accurate tool to assess hydrocarbon reserves. However, the expected pressure decline trends are often complicated by some unexpected geological phenomena.

i. Propose the geological variables that may cause unexpected production trends during initial production.

[3 marks]

ii. Construct a hypothetical Pressure Decline curve with some observed pressure data points.

[2 marks]

b. i. State a geological variable that may cause unexpected production trends during mid-life of the oil field.

[1 mark]

ii. Sketch a diagram to explain the occurrence of gas under-running.

[2 marks]

iii. Sketch a diagram to explain the occurrence of water up-running.

[2 marks]

-END OF PAPER-